ART. XIX.—*Report of the Committee of the Royal Society of Victoria, consisting of* PROFESSORS KERNOT, LYLE, and MASSON, and MESSRS. ELLERY, LOVE, and WHITE, *appointed to arrange for the carrying out of the Gravity Survey of Australasia.*

TO THE ROYAL SOCIETY OF VICTORIA.

GENTLEMEN,—In laying before you this, the Second Annual Report, your Committee has much pleasure in informing you that the work of the Survey has now commenced. The pendulums and other apparatus lent by the Royal Society of London—of which a description is appended—have been received, and erected in a cellar at the Observatory, kindly placed at the disposal of the survey by the Government Astronomer. The observing telescope sent with the apparatus proves to be somewhat inconvenient, and it is proposed to employ a different arrangement. The stand for the air-pump was badly packed, and found to be broken on its arrival; otherwise the instruments were in very fair order. It is proposed to devote the next few months to a careful examination of the effects of temperature and pressure on the times of oscillation of the pendulums; such an investigation being rendered especially necessary by the very considerable changes of temperature to which the instruments may possibly be exposed in the course even of a single set of swings. The values of the temperature and pressure coefficients for the pendulums numbered (4) and (1821) were worked out for the purposes of the Indian Survey; but the constants of the third pendulum, numbered (11), have not yet been determined. General Walker assumed them for the purposes of the Greenwich and Kew observations (lately completed) to agree with those of the other two; but your Committee is of opinion that the matter requires further investigation.

The question as to the construction of a new pendulum has received a good deal of attention from your Committee

during the past year. Fortunately the Royal Society of London has forestalled the discussion, and added pendulum (11) to the two originally asked for. The difficulty and expense attending the construction of a new pendulum has thus been avoided.

E. F. J. Love, *Secretary.*

Appendix.

Description of the apparatus to be employed in the Gravity Survey of Australasia, by E. F. J. Love, M.A.

In drawing up a description of the apparatus, we may consider separately, (*a*) the pendulums, (*b*) the clock, (*c*) the vacuum apparatus and its accessories.

(*a*) The pendulums are, undoubtedly, the most important portion of the apparatus. The three which it is proposed to employ are all constructed of the same materials, and practically identical, both in form and dimension. They are of the kind known as 'Invariable Pendulum." The form is a flat bar of plate brass 5 feet 2 inches long, 0·13 inch thick, and 1·7 inches broad, for a distance of 40 inches from the upper end. The remaining portion of the bar, termed the "tail-piece," is lenticular in section, reduced to a breadth of 0·7 inch, and terminates in a point. Just above the tail-piece is a flat circular brass bob, 6 inches in diameter and 1·3 inches thick, which is fastened to the bar by solder and rivets. The knife-edge is a prism of very hard steel, adjusted perpendicular to the plane of the bar, and attached by means of a stout T head. It is 2 inches long, 0·25 inch in height, and equilateral in section, save that the edge on which the oscillations are performed is ground to an angle of 120°. The planes on which the pendulum oscillates consist of two pieces of polished agate, ground true and set in a heavy brass frame supported on very massive levelling screws. Each pendulum has its own set of planes.

All three pendulums are about 70 years old, and have been repeatedly used for gravity survey work; in which they have given such consistent results as to warrant the belief that they have reached a condition of approximate equilibrium as regards molecular change. For a statement of their history, reference may be made to the "Report of the Great Trigonometrical Survey of India," Vol. V, Appendix p. 30.

With the pendulums is supplied a "dummy pendulum," of identical material and dimensions, into which two holes are sunk for the reception of the bulbs of a pair of thermometers. The dummy is placed in the same vacuum chamber with the pendulum when vibrating, and close to it. Their temperatures may accordingly be assumed as identical, and the temperature of the dummy, as given by the thermometers, can be employed for determining the temperature corrections to be applied to the pendulum. The corrections to be applied to the thermometers have been determined at Kew.

(*b*) The clock employed for the observation of coincidences is a siderial clock, made by Shelton, and was used by Sabine on his expedition in 1822. Its mean daily rate is very constant, but it is subject to rather considerable horary fluctuations of rate. The clock has an arrangement which allows of its being re-wound without loss of driving power during the winding.

(*c*) The vacuum apparatus consists of a cylinder of sheet copper, half closed at the top by a thick brass plate for supporting the agate planes, and closed in above this by a glass bell, ground to fit the brass plate; it is closed at the bottom by a metal hemisphere. It has one glass window about half-way up, through which the thermometers are read, and four others in the plane of the tail-piece of the pendulum. Through one pair the coincidences are observed, the other pair allowing a side view of the tail-piece, which is necessary for determining the amplitude of its vibration. To the sill of the back window is attached a brass plate bearing two scales at right angles to each other etched on ground glass, and with well blackened divisions for measuring this amplitude.

The cylinder is supported by three large levelling screws on a heavy iron girder, which is itself bolted to a very massive timber framework fastened together with iron bolts and clamps. The massiveness of the cylinder and frame render it quite impossible for the oscillations of the pendulum to be communicated to the supports.

The starting and stopping of the pendulum is performed by means of levers worked from outside the cylinder by metal rods passing through stuffing boxes, and cases filled with oil to prevent leakage of air.

A tap attached to the side of the cylinder is connected by rubber tubing to a Siphon barometer, and a second tap allows of the attachment of an air-pump in order to reduce the pressure to any desired amount, which is measured on the Siphon barometer.

As the tail-piece is only a little way above the ground, the short telescope with diagonal eye-piece sent with the apparatus is highly inconvenient. It is proposed to view the coincidences by means of a long telescope of considerable aperture, inclined at a small angle to the ground, and carrying a plane mirror in front of the object glass, so as to reflect the image of the apparatus in a nearly vertical direction. This method will result in a considerable saving of light, and a much more than considerable addition to the comfort of the observer. Anyone who has had experience in really delicate physical work will understand the importance of these considerations to the accuracy of the experiments.

In order that the images of the detached and clock pendulums may be in the same plane, a large lens is provided, by means of which an image of the clock pendulum is thrown on the ground glass scale inside the cylinder. The lens is mounted on a brass angle piece, which slides on a brass frame attached to a wooden stand. The stand rests by means of three levelling screws on a plank bolted to the framework which supports the cylinder.